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Influences of economic development in the Brazilian energy efficiency projects

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Abstract

This work has as main goal to present some of the issues regarding the effects of the Brazilian economy in the effectiveness of national energy efficiency projects in order to provide some guidelines for optimizing the energy saving actions. The replacement of traditional electric motors with high efficiency motors has been considered, or that brings innovation and increases the need to search for new technologies for Brazilian industries. We must consider whether this new paradigm requires a strong federal government's investment in Brazil in order to allow the implementation of energy efficiency programs, mainly in small and medium industries. This document is divided into three main parts. The first part deals with some aspects of the economic crisis. The second presents the most important data of the National Electricity Conservation (PROCEL) and Energy Efficiency Program of the ANEEL (National Electric Energy Agency). The third shows data on Small and Medium Industries and how their energy efficiency programs were affected.

Keywords

Energy efficiency, energy projects, Brazilian industry, electric motors, technological innovation.

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Introduction

It has been demonstrated that energy efficiency projects such as the replacement of standard electric motors by energy-efficiency motors can be looked at as important Research, Development and Innovation (R&D&I) projects, since they bring with them new products, and add new knowledge to business entrepreneurs and technicians.

It has become clear that expanding these projects requires incentives – currently the BNDES (National Bank of Economic and Social Development) and FINEP (Financing Agency for Studies and Projects) are the most important financers – and effective industrial policies. It was seen that energy efficiency programs should focus on the MSMBs (Micro, Small and Medium sized businesses), since this is the class of businesses that is faced with the greatest technological difficulties: they lack engineers or researchers involved in innovation and encounter difficulty financing these projects.

Economics aspects

According to the National Confederation of Industries (CNI) the number of hours worked in production fell 8% from November to December of 2008. Another cause for concern is regarding the level of utilization of manufacturing capacity, which fell from 81.4% in November to 80.2% in December. Flávio de Castelo Branco, the CNI's chief-economist, emphasized that the set of data for the last quarter of 2008 (in comparison with the previous year) is Brazilian industry's worst since 2003[1].

December of 2008 showed a retraction of 12.4% in industrial production in comparison with November, and 14.5% in comparison with the same month in 2007. Isabella Nunes, industrial coordination economist at the Brazilian Institute of Geography and Statistics (IBGE), pointed out that the retraction was widespread, affecting 25 of the 27 sectors studied. For example, the Electronic and Communications Materials sectors saw a -60.3% downturn in December, in comparison with November; for Machinery and Equipment, -21.9%; Basic Metallurgy, -24.5%[2]. In the view of the IBGE, this poor performance is related to the lack of credit and the lack of confidence on the part of business owners, and consumers as well, since they have reduced purchases out of fear of possible unemployment. Brazilian industry also suffered with the slowing of world commerce. Reductions in exports have for the most part affected the extractive industry with an 11.8% downturn from November to December of 2008[3].

The strong downturn in industry has a direct impact on investment plans and consequentially on the purchase of new equipment and machinery. The first projects to be hit were those aimed towards increasing energy efficiency. These were either cancelled, or in best-case scenarios, were postponed. Neumann (2009)[4], has also pointed out that […]

> […] *the dissemination of collective agreements reducing working hours and salaries, and also the strong increase in lay-offs in practically all sectors is going to*

[1] See: GOY, L. "Para CNI, País pode ter recessão". O Estado de S. Paulo. 4 de fevereiro de 2009. See too: GAVÃO, A. "Uso da capacidade instalada cai para 80,2% em dezembro". Valor Econômico. 4 de fevereiro de 2009.
[2] FARID, J. "Indústria brasileira despenca 12,4% em dezembro, pior queda em 17 anos". O Estado de S. Paulo. 4 de fevereiro de 2009.
[3] GRABOIS, A. P. "Demanda interna leva indústria a queda recorde e generalizada". Valor Econômico. 4 de fevereiro de 2009.
[4] NEUMANN, D. "Crise cortou ciclo de investimentos e efeitos irão além de 2009". Valor Econômico. 4 de fevereiro de 2009.

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> *affect our internal situation even more and, consequentially, domestic demand* (NEUMANN, 2009).

Clearly, projects to reduce electricity use are not yet a priority for industry. In other words, little progress was made during the first half of 2009 regarding energy efficiency.

In August of 2009, industry is beginning to show signs of recovery. In August and September, 35,000 people accessed the Brazilian Association of the Machine and Equipment Industry (Abimaq) website to obtain information about financing for purchasing machinery. This number is the same as the one recorded for the entire year of 2008, with 37,000 accesses. Another interesting piece of data refers to the use of industry's manufacturing capacity. Research conducted by the Getúlio Vargas Foundation (FGV) shows that it increased 1.5% between July and August. In August of 2009, the use of this capacity reached 81.3%, achieving practically the same percentage as in November, 2008[5].

National Electricity Conservation Program

The objective of the National Electricity Conservation Program (PROCEL) is to encourage rationalization of electricity production and consumption. PROCEL was created in December of 1985 by the Ministries of Mines and Energy and Industry and Commerce, and was administered by an Executive Secretary subordinate to ELETROBRÁS (Centrais Elétricas Brasileiras). In 1991, PROCEL was transformed into a Government Program and its range and responsibilities increased. Procel's main results, from 1986 to 2009, are shown in Table 1 <www.eletrobras.gov.br/procel/site/home/>.

The Table 1 shows the results cumulated by Procel. The total investments made are bigger than 1,12 billion of real, besides the saved energy is equivalent to a 9.105 MW power plant.

In November of 2006, Eletrobrás/PROCEL launched the PROCEL INFO portal <www.procelinfo.com.br>, the Centro Brasileiro de Informação de Eficiência Energética (Brazilian Energy Efficiency Information Center). The objective of PROCEL INFO is to bring together and make available information of interest to professionals working in the field of energy efficiency, facilitating their integration and in this way becoming a Brazilian point of reference in the dissemination of quality information about the rational and efficient use of energy.

During the one-year period November 2006-2007, an average of 306 users signed up every month for an approximate total of 3,700. Out of these users, approximately 40% are from Rio de Janeiro and São Paulo. The majority of users are from the states of Rio de Janeiro and São Paulo, a consequence of the portal's strategy to target intermediary agents in the field of energy efficiency (concentrated in the Brazilian Southeast)[6].

Another important aspect related to energy efficiency refers to energy concession contracts. Concession contracts signed between energy distribution companies and the Brazilian Electricity Regulatory Agency (ANEEL) establish a series of obligations and charges. One of these obligations "consists in applying the upstream of at least 0.5% of its net operating revenue each year to energy efficiency projects"[7]. In order to comply with this obligation,

[5] CHIARA, M. "Indústria se prepara para voltar a crescer". O Estado de S. Paulo, 14 de setembro de 2009.
[6] NATURESA, J. S.; MARIOTONI, C. A.; MENEZES, T. V.; PERRONE, F. P. D. e LEPETITGALAND, K. K. "Respostas para a crise de energia elétrica: Eficiência Energética, Uso racional de energia e Fontes Renováveis". AGRENER GD 2008 - 7º Congresso Internacional sobre Geração Distribuída e Energia no Meio Rural. 2008a.
[7] ANEEL – Agência Nacional de Energia Elétrica – <www.aneel.gov.br>.

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concessionaires must present a series of projects making up their Energy Efficiency Annual Program, which should contain both physical and financial goals.

Table 1. Principal results of PROCEL (1986 to 2009).

PROCEL (1986-2009)	1986/2003	2004	2005	2006	2007	2008	2009
Investment Eletrobras / Procel (R$ million)[(a)]	252,01	27,18	37,17	29,24	13,62	5,49	9,02
Investment RGR (R$ million)[(b)]	12,00	54,00	44,60	77,80	39,16	25,8	55.95
Investment on the Project of Energy Efficiency for Brazil (R$ million)[(c)]	2,09	12,97	16,23	6,20	–	–	–
Total Investment Done (R$ million)	666,08	94,15	98,02	113,24	52,78	31,29	64,97
Energy Saved (billion of kWh/year)	17,22	2,373	2,158	2,845	3,930	4,374	5,473
Reduction of Demand at Pick (MW)	4.633	622	585	772	1.357	1.569	2.098
Power Plant Equivalent (MW)[(d)]	4.033	569	518	682	942	1.049	1.312
Investment Postponed (R$ billion)	10,65	2,50	1,77	2,23	2,8	2,9	3,9

Source: Results of Procel 2009 e <www.eletrobras.com/procel> (May-2010).

[(a)] Refer just to budget resources of Procel effectively done each year, not being considered the labor salaries of Eletrobras/Procel.

[(b)] RGR (Global Reserve of Reversal) is the federal fund formed with electrical companies, proporcional to the investment of each one.

[(c)] Refer to the investment of US$ 11,9 millions of the GEF (*Global Environment Facility*) and the counterpart of Eletrobras.

[(d)] Obtained from the energy saved, considering a typical médium factor of capacity of 56% for hydroelectric power plants including 15% of medium losses in the T&D for the parcel of energy conservation.

Table 2 presents this project's results, defining the number of participating companies, investments realized, demand avoided and energy saved. It can be seen that during the period from 1998 to 2006, R$ 1.919 billion was invested, resulting in energy savings of 5,559 GWh. Table 3 shows the types of projects carried out (period 2000/2001 to 2004/2005). Note that the majority of these projects were aimed at low-income consumers through the replacement of old refrigerators for new ones and incandescent bulbs for electronic ones (NATURESA *et al.*, 2008b)[8].

Energy Efficiency Investment Programs

Although many programs to support and encourage increased energy efficiency exist, the government has yet to implement an effective, wide-reaching policy to encourage factories to invest in conservation and rational use of energy, which would necessarily involve the replacement of obsolete and inefficient equipment for new, efficient equipment. According to Naturesa *et al.* (2008b) it is the responsibility of […]

> […] *industrial policies to speed up those processes of production transformation that market forces can operate – albeit slowly – and trigger those processes which the same forces are incapable of articulating* (NATURESA *et al.*, 2008b).

Industrial policy should include measures concerned with encouraging […]

[8] NATURESA, J. S.; MENEZES, T. V.; MARIOTONI, C. A.; PERRONE, F. P. D.; LEPETITGALAND, K. K. e BASTOS, F. C. "Levantamento dos Programas de Eficiência Energética para Sistemas Motrizes na Indústria e os Principais Resultados do PROCEL INFO". AGRENER GD 2008 - 7º Congresso Internacional sobre Geração Distribuída e Energia no Meio Rural. 2008b.

> […] *simultaneously, increases in international market insertion of industry's cutting edge companies (through exports and substitution of imports) and modernization of industry's core companies, integrating already established sectors, with large participation of small and medium sized businesses aimed at the domestic market* (*idem*, 2008b).

Modernization of industry's core companies will only be obtained with energy efficiency, since this reduces these companies' consumption of electricity, thereby leading to reduced production costs. Also according to Naturesa *et al.* (2008b), industrial policy should be organized into three components (i) modernization policies, (ii) restructuring policies and (iii) competitive and regulatory policies. Energy efficiency projects should be included in the modernization policies, since they work towards improving business production, managing and commercial capacity.

Table 2. Distributor investment in research and energy efficiency.

Cycle	Number of Companies	Investments (R$ millions)	Demand avoided (MW)	Energy Saved (GWh/year)
1998/1999	17	196	250	755
1999/2000	42	230	370	1020
2000/2001	64	152	251	894
2001/2002	64	142	85	348
2002/2003	64	154	54	222
2003/2004	64	313	110	489
2004/2005	64	175	275	925
2005/2006	64	296	141	538
2006/2007	60	261	138	368
Total		**1919**	**1674**	**5559**

Source: ANEEL – Agência Nacional de Energia Elétrica – <www.aneel.gov.br>.

Table 3. Types of projects carried out (period 2000/2001 to 2004/2005).

Type	Investments (R$ millions)	Demand avoided (MW)	Energy Saved (GWh/year)
Public lighting	374.6	175	797
Residential	133.5	313	930
Industrial	96.0	59	376
Public Services	91.3	118	312
Education	80.9	25	90
Trade and Services	59.5	30	130
Government	34.8	14	57
Solar heating	19.4	n.d.	n.d.
Rural	14.6	9	83
Losses	12.4	17	79
City Energy Management	11.5	n.d.	n.d.
Load factor	11.2	6	0.6
Total	**939**	**765**	**2853**

Source: ANEEL – Agência Nacional de Energia Elétrica – <www.aneel.gov.br>.

At the beginning of May 2008 the government launched a new industrial policy called the Production Development Policy (PDP). The objective of this policy is to stimulate exports, investments and innovation. The measures add up to R$ 21.435 billion in disencumbrance from now until 2011 and disbursements via the National Bank of Economic and Social

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Development (BNDES) of R$ 210.4 billion from now until 2010. Regarding innovation and research and development (R&D), BNDES offers a Long Term Interest Rate (TJLP) of 6.5% per year for R&D and 4.5% per year for innovation[9]. The program's main objectives are to: increase fixed investments; increase private sector innovation; stimulate industrial sector innovation through private investments in research and development; expand exports; increase Brazilian participation in world exports to 1.5% of world trade in 2010; elevate small and medium sized business' exports; increase the number of Brazilian micro and small exporting businesses by 10%.

The PDP is divided in three categories, as follows: programs to mobilize strategic areas (nuclear energy, nanotechnology and biotechnology); programs to strengthen competitiveness (agroindustry, biodiesel, plastics, textiles and furniture); and programs to consolidate and expand leadership (petroleum, gas and petrochemical, mining, steelmaking, pulp and paper, and meat).

The main measures used to achieve these objectives are[10]:

- Reducing BNDES financing costs and increasing subsidies to export sectors;
- Give federal, state and city government purchasing preference to national sectors that invest in innovation, research and development;
- With PIS/Cofins (Social Integration Program/Contribution for the Financing of Social Security) taxes, reduction of the time it takes for companies to be reimbursed with credits of these taxes;
- With income tax, accelerated depreciation of machinery and equipment acquired to increase production capacity.

The program's general coordination will be the responsibility of the Ministry of Development with the support of an executive-secretary made up of the Brazilian Industrial Development Agency (ABDI), BNDES and the Ministry of Finance. The new industrial policy directly benefits energy efficiency programs and the BNDES has become an important source of financing of these programs.

In August'2009 the FIESP (Federation of the Industries of the State of São Paulo), Brazil, has published a research about the impact of PDP in the industries of State of São Paulo, developed in October of 2008, consulting 450 industries. One of the results of that research shows "the high degree of lack of knowledge of the politics of productive development (PDP) that affects about 45% of the total industries". That emphasizes the greater part of the businessmen (65%) considers positive the studies made, but presents a low expectation on the viability (87%). The main reasons by this low expectation are the hard government taxes and the difficulties to access the program.

The barriers which deserve to be observed about the increase on demand for instruments da PDP are absence of both information and the regulation of the products suitable to the necessities of the industries. Related to the impact of the PDP actions, 29% of the businessmen believes thta would not be any impact and 46% believes that the positive impact is to be low resulting in a high level of skepticism. That means the effects of PDP on industries are much less expected than those expected on the economy (FIESP, 2009).

[9] See: POLÍTICA DE DESENVOLVIMENTO PRODUTIVO. <http://www.desenvolvimento.gov.br/pdp/>. See too: D'AMORIM, S., LAGE, J. e MACHADO, R. "Desoneração da indústria atinge R$ 2 bi". Folha de S. Paulo, 13 de maio de 2008.
[10] See: POLÍTICA DE DESENVOLVIMENTO PRODUTIVO. <http://www.desenvolvimento.gov.br/pdp/>. See too: TEREZA, I. "Bens de capital e inovação terão destaque". O Estado de S. Paulo, 11 de maio de 2008.

Innovation

The fastest growing countries around the world invest heavily in research and development in order to obtain innovative products and processes. According to Arbix (2007)[11], the process of innovation results in interactions between individuals, businesses and other knowledge producing institutions on the local, national and global level.

According to Industrial Research in Technological Innovation[12], between 1998 and 2000, in Brazil the recommendation to innovate only in terms of the process predominated, while for the years 2001-2003, more companies adopted the strategy to innovate in both products and processes, increasing from 11.3% in the first period to 14% in the second. Table 4 illustrates the types of innovation in Brazil for the periods 1998-2000 and 2001-2003. Rosenberg (2006)[13] explains the concept of process innovation:

> *Process innovations typically involve new equipment or machinery, where the innovations are incorporated; this machinery and equipment are also product innovation, from the point of view of the company that produces it* (ROSENBERG, 2006, p.19).

Regarding the innovation point of reference, new processes for industry in Brazil fell from 2.8% for the 1998-2000 period, to 1.2% for the 2001-2003 period. On the other hand, new processes for companies rose from 23.3% to 26%, respectively. According to the study:

> […] *the reduction in innovation on the domestic market took place in all sizes of companies, which suggests the influence of the macroeconomic situation in decisions on technological development made during the 2001-2003 period* (PINTEC, 2003).

Table 4. Percentage of companies implementing innovations. Brazil: (1998-2000) and (2001-2003).

Type	1998-2000	2001-2003
Product and process.	11.3	14
Product only	6.3	6.4
Process only	13.9	12.9
That implemented innovations	31.5	33.3

Source: PINTEC – Pesquisa Industrial de Inovação Tecnológica. 2003. Disponível em <http://www.ibge.gov.br>.

The fundamental point of this research refers to the impact of innovation on the companies. During both periods, the following effects of innovation were observed most: increased production flexibility and capacity, expansion of the company's market participation, maintenance of the company's market participation and product quality improvements.

It can clearly be seen that Brazilian industry has sought to establish alternatives to leverage its growth on a national scale, although emphasis has not been placed on innovation, which demands more daring and effective industrial policy on the part of the Brazilian government. It is in this intricate context, in which industry does not receive incentives to invest in energy efficiency programs, that the proposal to at the very least replace old equipment with new, more energy efficient versions, comes to be looked at by the country as a technological

[11] ARBIX, G. Inovar ou inovar – a indústria brasileira entre o passado e o futuro. Editora Papagaio. 2007.
[12] PINTEC – Pesquisa Industrial de Inovação Tecnológica. 2003. Disponível em <http://www.ibge.gov.br>.
[13] ROSENBERG, N. Por dentro da caixa-preta – Tecnologia e Economia. Editora da Unicamp. 2006.

innovation strategy. At the end of the year 2010 it has been presented the PINTEC-2008 with a new classification of the economic activities, making more difficult the comparison with elder results. The Table 5 shows the innovation rates of both the extraction and the transformation industries between the years 1998 and 2008. That comparison has been made by CAVALCANTE & DE NEGRI (2010).

Table 5. Innovation rates of both the extraction and the transformation industries between the years (1998-2008) – (%).

Year	Innovation rate	Innovation rate of new product to industry	Innovation rate of new product to the market	Innovation rate of new process to empresa	Innovation rate of new process to national market
1998-2000	31,52	14,38	4,13	23,27	2,78
2001-2003	33,27	18,08	2,73	26,04	1,21
2003-2005	33,36	16,67	3.25	25,48	1,66
2006-2008	38,11	19,93	4,10	30,83	2,32

Source: adapted from CAVALCANTE & DE NEGRI (2010).

Analyzing the Table 5 it is possible to see that there was a increasing in the innovation rate between the years 1998 and 2008, increasing from 31,52% to 38,52%. On the other hands, the innovation rate of new product for the Market and the new process for the market have decreased from 4,13% to 4,10% and from 2,78 to 2,32%, respectively.

> *The rate of innovation for both products and process, for the market, have been greater just for the first edition of PINTEC (1998 to 2000), probably due to the newness of concepts and the inherent difficulties to respond the questions* (CAVALCANTI & DE NEGRI, 2010).

The second *"Congresso Brasileiro de Inovação na Indústria"* (Brazilian Industrial Innovation Conference) was held in April of 2007. The main conclusions reached by the event were: Brazil needs to double its investments in R&D in the coming years; Brazilian industry has expanded its efforts in research and development, although the rhythm of investment increases was insufficient to insert companies in foreign markets; the Brazilian Innovation System is in need of improvement; innovation policy institutions and instruments should be the subject of constant evaluations. One point that deserves attention refers to the great lack of knowledge on the part of small and medium sized businesses about instruments that are available to stimulate technological innovation[14].

In May-2009 it has been organized the 3th Brazilian Congress on Industry Innovation. In that Congress it has been presented the "Letter for Industry Innovation", with the aim of doubling the number of Innovating Companies in 4 years (Innovation: The Construction of the Future, 2009). This Congress was smaller than the before ones, perhaps due to the slow country industrial increasing ratio at this period. It must be emphasized the webpage of this event that shows many innovation success cases, an excellent page for studies and discussion <http://www.inovacaocni.com.br/home.aspx>.

In terms of financing for innovation, the PITCE (Industrial, Technological and Foreign Trade Policy) has expanded its mechanisms for financing companies' research and development. According to the National Confederation of Industries (CNI) several public financing

[14] See: MARIOTONI, C. A. & NATURESA, J. S. "Inovação Tecnológica, Eficiência Energética e os Investimentos na Indústria Brasileira". Congresso Brasileiro de Eficiência Energética. 2007. See too: CNI – Confederação Nacional da Indústria. Inovar para Crescer: propostas para acelerar o desenvolvimento tecnológico da Indústria Brasileira. Segundo Congresso Brasileiro de Inovação na Indústria. 2007. <http://www.cni.org.br/inovação>.

programs and instruments have been created and improved for the area of innovation, including: non-reimbursable resources, such as subsidies; reimbursable credit; and venture (or entrepreneurial) capital. Once again, FINEP and the BNDES appear as the main financing institutions.

Regarding FINEP, its programs that deserve the most attention are: "Pró-inovação" Pro-innovation; PAPPE (Support Program for Research in Small Companies) and the "Juro Zero" (Zero Interest) program. CNI (2007)[15] highlights the following proposals: increase access to existing lines of financing; define an appropriate volume of resources for equalizing financing; stimulate participation of other public financing institutions, especially Banco do Brasil (Bank of Brazil), CAIXA (Brazilian Federal Savings Bank) and development banks; reduce bureaucracy and facilitate credit access for businesses; train BNDES and FINEP technicians towards greater understanding of business expenses in technological development and innovation; and coordinate work by financing agencies like the BNDES and FINEP in such a way as to optimize the use of available resources.

Micro, Small and Medium Sized Businesses

According to Law no. 11,196/2005, article 17:

> *Technological innovation is defined as the conception of a new product or **manufacturing process**, as well as the addition of new functions or characteristics to products or processes, resulting in incremental improvements and effective **gains in quality or productivity**, leading to greater market competitiveness* (authors' italics).

Mariotoni & Naturesa (2007)[16] have demonstrated the main strategies towards the creation of industrial policy aiming towards the technological innovation focused on energy efficiency of Micro, Small and Medium Sized Businesses (MSMBs). That is, the replacement of old equipment with new, more energy efficient versions should be seen by the country as a strategy for technological innovation.

In order to prove how important MSMB investments in energy efficiency are, Table 6 shows the percentage of net income spent on electricity by different establishments. For more than 10% of micro and small businesses energy costs consumed 5-7.5% of the net revenue. In northern Brazil, 14.3% of the establishments spent more than 10% of their net revenue on electricity.

According to the CNI (2005)[17], little articulation exists between development agencies, research institutes and public organizations from the science, technology and innovation system. Additionally, access to credit on the part of MSMBs is made difficult by the countless demands made by financial institutions for collateral.

According to CNI (2006)[18], the percentage of Micro and Small Businesses (MSBs) that invested in acquiring Brazilian made machinery and equipment in 2003 was 78%, greater than the 52% recorded in 1999. Regarding Research and Development (R&D), investments were low for the MSBs. For micro-businesses, 47% did not invest in R&D, while for small businesses this percentage is lower, at 23.7%, a figure closer to that of medium sized

[15] CNI (2007). Inovar para crescer: propostas para acelerar o desenvolvimento tecnológico da Indústria Brasileira.
[16] MARIOTONI, C. A. & NATURESA, J. S. "Inovação tecnológica, eficiência energética e os investimentos na Indústria Brasileira". Congresso Brasileiro de Eficiência Energética. 2007.
[17] CNI. Políticas Públicas de Inovação no Brasil: A Agenda da Indústria. Brasília, novembro de 2005. <http://www.cni.org.br/inovacao/>.
[18] CNI. Crescimento. A visão da indústria. 2006. <http://www.cni.org.br>.

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companies. Investments carried out in 2003 were concentrated on the acquisition of machinery and equipment, human resources training, product and process development and on placing innovative products on the market. The Brazilian northeast deserves special attention, as nearly all companies (approximately 70%) invested in R&D.

Investment carried out in 2003 were concentrated on the acquisition of machinery and equipment (63%), human resources training (46%), product and process development (44%) and on placing innovative products on the market (35%) (CNI, 2006).

Tidd; Bessant & Pavitt (2008)[19] confirms that the frequency of innovation for companies with less than 100 employees is much lower than in large companies. Table 7 shows the frequency and sources of innovation by business size in France (1993-1994). Reading the table, it can be seen that only 55% of companies with less than 50 employees are innovative. For companies with more than 100 employees, the percentage rises to 70%. This proves that small companies, be they in Brazil or France, are the ones most in need government support to encourage any kind of process towards innovation.

Table 6. Percentage of net revenue spent by establishments on electricity.

	Up to 2.5%	2.5 – 5%	5 – 7.5%	7.5 – 10%	Greater than 10%
Size					
Micro and small	54%	22.7%	10.8%	6.3%	6.3%
Micro	53.9%	24.2%	10.2%	5.5%	6.3%
Small	54%	21.0%	11.6%	7.1%	6.3%
Geographic Region					
North	33.3%	28.6%	14.3%	9.5%	14.3%
Northeast	60.5%	20.9%	4.7%	9.3%	4.7%
Central-West	52.5%	18.6%	16.9%	3.4%	8.5%
Southeast	50.7%	25.6%	9.7%	6.6%	7.5%
South	61.5%	19.2%	11.5%	5.4%	2.3%

Source: CNI. Crescimento. A visão da indústria. 2006. <http://www.cni.org.br>.

As it has already been stated, only the Financing Agency for Studies and Projects (FINEP) and the National Bank of Economic and Social Development (BNDES) have credit lines specifically aimed at innovation (CNI, 2007).

FINEP's "Juro Zero" (Zero Interest) program seem to be the most appropriate for financing energetic innovation in small and medium sized businesses. The program was created with the objective to facilitate concession of financing towards innovation in small businesses, through special conditions for access, such as the creation of a credit guarantee fund, zero interest, and the adoption of simplified procedures for analyzing and approving projects (MORAIS, 2008)[20].

The program was launched in 2004, but began operating in 2006. First, the states of Pernambuco, Paraná, Bahia, Minas Gerais and the Florianópolis Metropolitan Area received R$ 20 million for the concession of loans to small businesses. The loans varied from R$ 100,000-900,000 and were subject to a limit of 30% of the company's revenue, requiring a minimum annual revenue of R$ 333,300 and a maximum of R$ 10.5 million. By December of 2007 the Zero Interest Program accepted 46 innovation projects for a total of R$ 26.1 million. The majority of projects belong to the software segment (9 projects) followed by

[19] TIDD, J.; BESSANT, J. & PAVITT, K. Gestão da Inovação. Editora Bookman. 2008.
[20] MORAIS, J. M. "Uma avaliação de programas de apoio financeiro à inovação tecnológica com base nos Fundos Setoriais e na Lei de Inovação" *in* João Alberto de Negri & Luis Cláudio Kubota (Organizadores), Políticas de Incentivo à Inovação Tecnológica. IPEA – Instituto de Pesquisa Econômica Aplicada. 2008.

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biotechnology (4 projects). On average, the companies employ 25 people and have an average annual revenue of R$ 3,472,000 (MORAIS, 2008).

Table 7. Frequency and source of innovation by business size in France (1993-1994).

Sources of Innovation (%)							
Size of Company	Innovative Businesses	Own R&D	Partial R&D	External R&D	Licenses	Machinery Supplier	Material Supplier
20-49	55	16	25	10	5	26	18
50-99	66	19	25	10	5	23	16
100-199	70	21	25	11	5	22	16
200- 499	80	24	24	12	6	20	15
500-1999	86	26	23	13	6	19	14
2000+	96	25	21	14	6	18	14

Source: TIDD, J.; BESSANT, J. & PAVITT, K. Gestão da Inovação. Editora Bookman. 2008.

YOSHINO (2003) has done some studies about the main barriers related to the energy efficiency in micro, small and medium industries in the State of São Paulo, Brazil. He has visited many industries in the interior of the State, mainly the cities of Americana and Franca. Yoshino has seen on these two city areas, that some medium industries have engineers of good profissional level, which already have done studies of energy conservation, but the measurements did not become reality. That have been explained by the researcher that businessmen have a short term vision and do not worry about the strategy of rational use of energy.

Conclusions

The politics of productive development (PDP) is supported by four pillars: increased fixed investments; increased private sector innovation; expansion of exports and stimulating exports for small and medium sized companies. In our understanding, these objectives should necessarily undergo a reformulation of Brazilian industry through the replacement of obsolete and inefficient equipment. We believe that energy efficiency projects can be looked at as important R&D&I projects, since they bring new products with them and new knowledge for business owners and company technicians.

The largest financers of said changes continue to be the BNDES and FINEP. The greatest cause for concern is related to the coordination and evaluation of new projects. The University-Industry interface continues to be a great impediment to collaborative projects. In any case, the new industrial policy constitutes an important step forward for energy efficiency projects, as it is for industrial development (especially of micro, small and medium sized businesses) and the development of the country as a whole.

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